# A *Superior* Research Reader

Volume 6, July 2015

Photo Credit: Oklahoma State University, Wisconsin DNR, Pooja Kanwar

Greetings and welcome to A *Superio*r Research Reader, a monthly reader on what we believe is current and relevant research to science and resource management on the Superior.

## This Month's Edition: Microcosm

Soil, pollinators, worms and parasites—that's the focus of this month's Microcosm Reader. This month we want to steer your attention to the little guys—the microbes and invertebrates of the forest. Although many of these lifeforms are not visible to the naked eye, their presence and role in forest ecosystem health is critical. From disturbance recovery and ecosystem function to moose population decline and invasive species spread, by reading the articles we've highlighted below you'll see that these little critters have big impacts.

And as a very special bonus this month, be sure to check out an article published just this week about vibrantly treasured pollinators found in Superior National Forest.

Happy reading,

*Pooja and Katie*

Editors of A *Superior* Research Reader
poojaskanwar@fs.fed.us and kfrerker@fs.fed.us

1. Craigg and colleagues attempt to bridge the gap between soil science and decision-making by helping forest managers better understand the value of soil information in project planning.

2. Our neighbors at Voyageurs National Park present research about a parasite contributing to the decline in moose populations in our region.

3. Dávalos et al. use field data to show how non-native earthworms can interact with other factors to promote invasive plant species growth.

4. Kerr and his team of researchers confirm that bumblebees are in steep decline at a continental scale because of climate change.

Soil Matters: Improving Forest Landscape Planning and Management for Diverse Objectives with Soils Information and Expertise

Craigg et al. 2015. Journal of Forestry

ABSTRACT: Most forest managers would agree that soils are a fundamental resource of forestlands, yet many planning and management decisions continue to be made without a detailed and spatially explicit understanding of this unique and vital resource. We discuss the value of soil data and interpretations in forest planning. We emphasize that soil types differ widely in their inherent capacity to perform various ecological functions as well as in their dynamic response to and recovery from disturbances—concepts that can greatly enhance the quality of forest management decisions. We make a case for applying these concepts by introducing an adaptive management model that targets the use of soil information during forest planning and management. Our goal is to help bridge the gap between soil science and decision-making by helping forest managers better understand the value of soil information in project planning. A case study highlights applications and potential benefits.

Diversity and Abundance of Terrestrial Gastropods in Voyageurs National Park, MN: Implications for the Risk of Moose Becoming Infected with Parelaphostrongylus tenuis

Cyr et al. 2014. Alces

ABSTRACT: Voyageurs National Park (VNP) has a stable population of about 40–50 moose (*Alces alces*). Recent declines in moose abundance in adjacent areas in northern Minnesota raise concerns about the long-term viability of moose in VNP. The parasitic nematode *Parelaphostrongylus tenuis* has been documented in moose in VNP and has been implicated in moose declines in other populations. Terrestrial gastropods are the intermediate hosts for *P. tenuis*, and describing spatial and temporal differences in their abundance should increase understanding about the risk of *P. tenuis* infection for VNP moose at the individual and population levels. We used cardboard sheets to estimate species composition and abundance of terrestrial gastropods in representative vegetation communities in VNP. We collected a total of 6,595 gastropods representing 25 species, 22 terrestrial snails and 3 slugs; 8 are known vectors of *P. tenuis*, including the slug *Deroceras laeve*, the most common species found. Gastropods were more abundant in September than July, and in upland forests (maximum = 555 gastropods/$m^2$) more than in wetter lowlands (20 gastropods/$m^2$). We used location data from GPS collared moose in VNP to estimate the relative exposure of moose to gastropods that could be infected with *P. tenuis* larvae. The boreal hardwood forest and northern spruce-fir forest ecotypes had the highest use by moose and high abundance of *P. tenuis* vectors in summer, and may pose the greatest risk for infection. Habitat use and the related risk of ingesting gastropod vectors varied by individual moose. Our method can be extended in moose range to estimate the relative risk of *P. tenuis* infection.

Single and interactive effects of deer and earthworms on non-native plants

Dávalos et al. 2015. Forest Ecology and Management

ABSTRACT: Understanding drivers of plant invasions is essential to predict and successfully manage invasions. Across forests in North America, increased white-tailed deer (*Odocoileus virginianus*) abundance and non-native earthworms may facilitate non-native plant invasions. While each agent may exert independent effects, earthworms and deer often co-occur and their combined effects are difficult to predict based solely on knowledge of their individual effects. Using a network of twelve forested sites that differ in earthworm density, we evaluated deer exclusion effects (30 × 30 m; with an adjacent similar sized unfenced control plot) on cover, growth and reproduction of three non-native plant species: *Alliaria petiolata*, *Berberis thunbergii* and *Microstegium vimineum*. In addition, we assessed interactive effects of deer exclusion and earthworm invasions on *B. thunbergii* ring-growth. Five years after fence construction, *A. petiolata* frequency and density, *B. thunbergii* height, and *M. vimineum* cover were all significantly lower in fenced compared to open plots. In addition, *B. thunbergii* ring-growth was significantly lower in fenced compared to open plots, and ring-growth was positively correlated with earthworm density. Moreover, deer access and earthworm density synergistically interacted resulting in highest *B. thunbergii* ring-growth in open plots at sites with higher earthworm density. Results indicate facilitative effects of deer on non-native plant species and highlight the importance of understanding interactions among co-occurring factors in order to understand non-native species success. Successful long-term control of invasive plants may require a reduction in deer abundance, rather than just removing invasive plant species.

Climate change impacts on bumblebees converge across continents

Kerr et al. 2015. Science

ABSTRACT: For many species, geographical ranges are expanding toward the poles in response to climate change, while remaining stable along range edges nearest the equator. Using long-term observations across Europe and North America over 110 years, we tested for climate change–related range shifts in bumblebee species across the full extents of their latitudinal and thermal limits and movements along elevation gradients. We found cross-continentally consistent trends in failures to track warming through time at species' northern range limits, range losses from southern range limits, and shifts to higher elevations among southern species. These effects are independent of changing land uses or pesticide applications and underscore the need to test for climate impacts at both leading and trailing latitudinal and thermal limits for species.